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Shields

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(54) **SYSTEM FOR COOLING INK AND OTHER LIQUIDS ON A PRINTING PRESS**

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(73) Assignee: **Graymills Corporation**, Chicago, IL (US)

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Related U.S. Application Data

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(51) **Int. Cl.**[7] **B41F 3/40**; B21B 45/02

(52) **U.S. Cl.** **101/364**; 101/216; 101/487; 15/256.52

(58) **Field of Search** 101/364, 350.6, 101/362, 367, 216, 487, 187, 142; 118/262; 15/256.52

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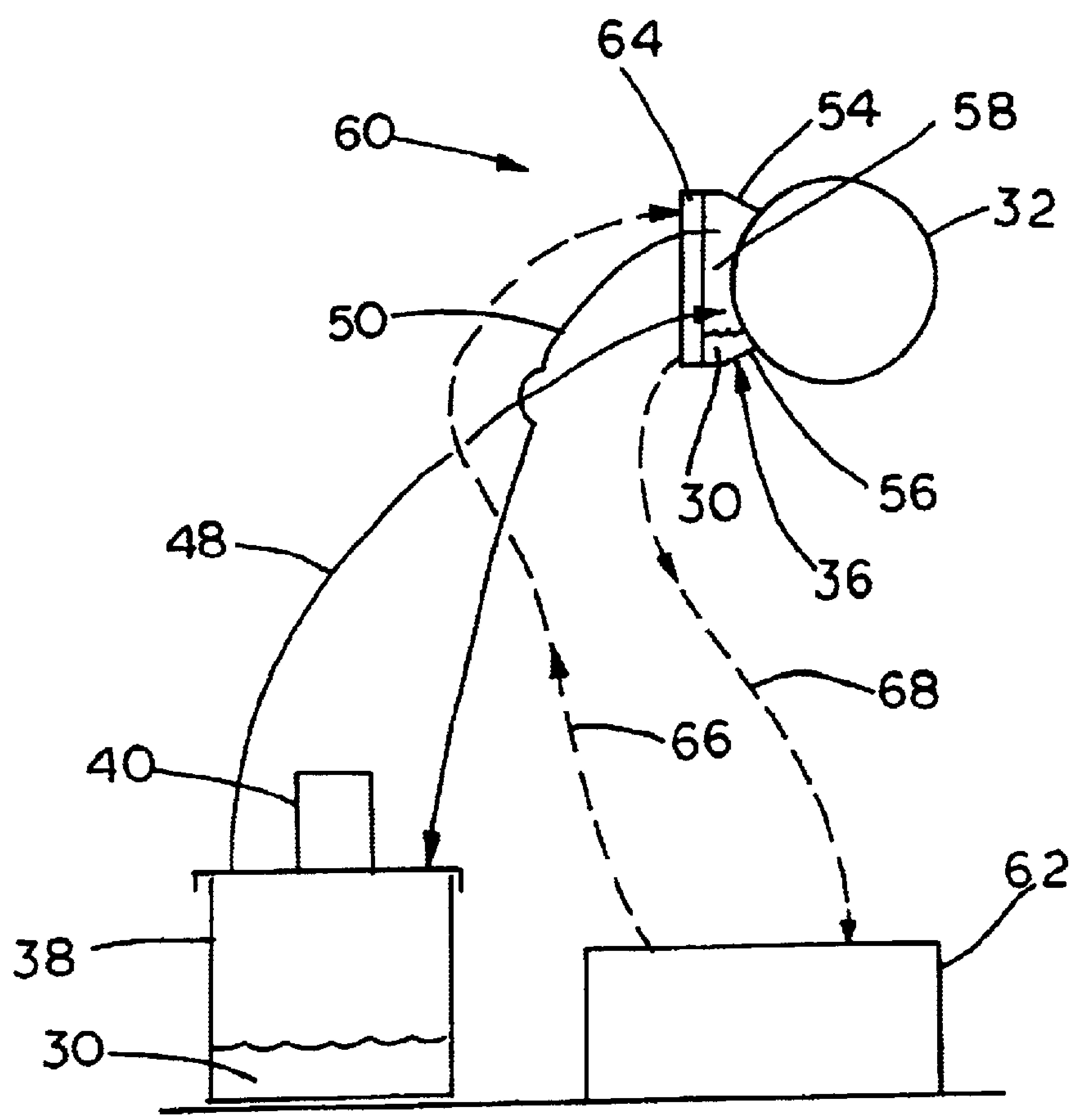
Primary Examiner—Eugene H. Eickholt
(74) *Attorney, Agent, or Firm*—Marshall, Gerstein & Borun LLP

(57) **ABSTRACT**

An ink cooling system for printing presses is disclosed. The ink cooling system is arranged to cool ink at locations within a printing press at the locations in which the ink properties are most likely to be adversely impacted, and which locations are or may be physically remote from the centralized ink supply or ink tanks. The disclosed system thus counteracts localized heating that commonly occurs in printing presses, thus minimizing or eliminating printing problems caused by heated ink.

36 Claims, 13 Drawing Sheets



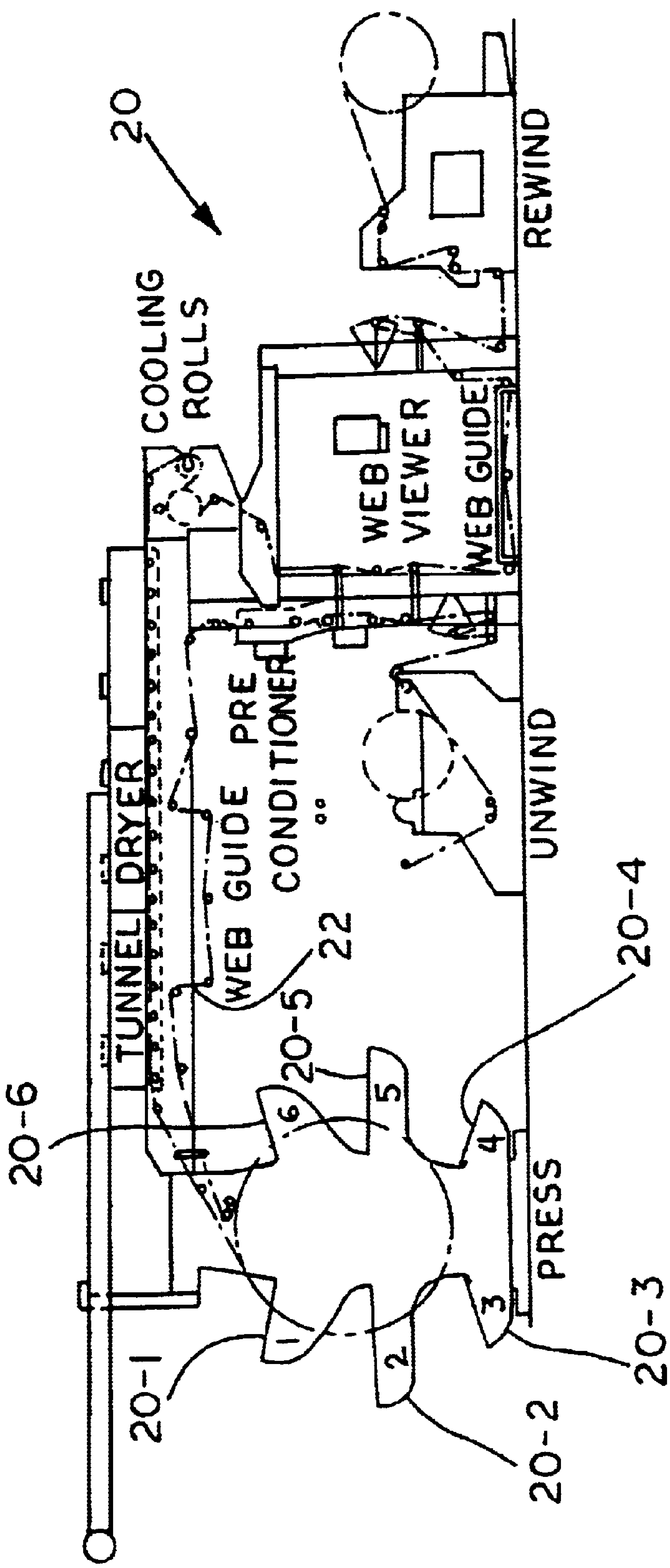

20
COOLING ROLLS
REWIND
WEB VIEWER
WEB GUIDE
PRE CONDITIONER
WEB GUIDE
UNWIND
TUNNEL DRYER
22
20-5
20-4
20-6
PRESS
20-1
20-2
20-3
1
2
3
4
5
6

FIG. 1

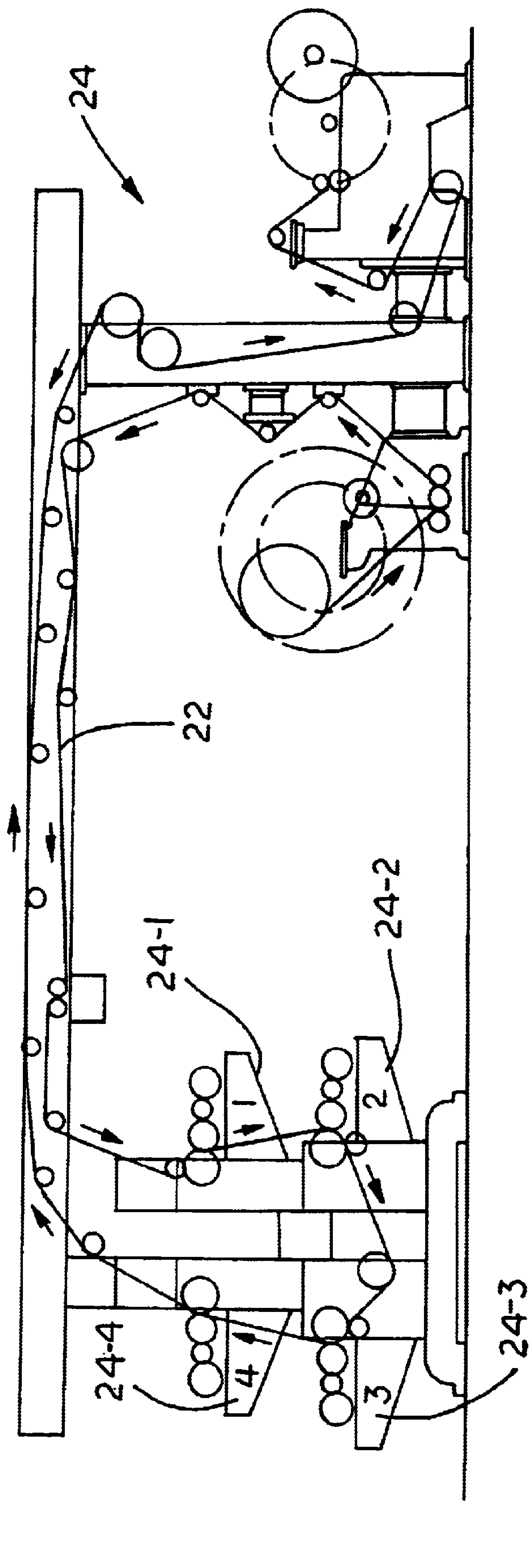


FIG. 2

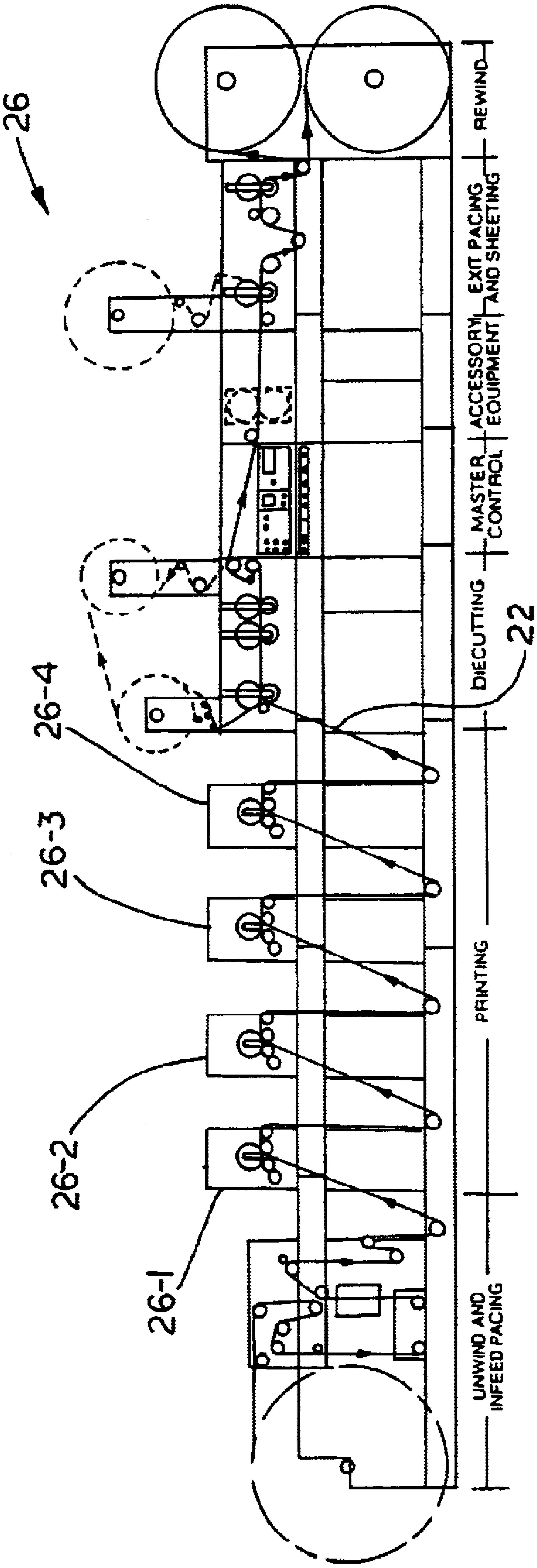

26
26-1
26-2
26-3
26-4
22
UNWIND AND INFEED PACING
PRINTING
DIECUTTING
MASTER CONTROL
ACCESSORY EQUIPMENT
EXIT PACING AND SHEETING
REWIND

FIG. 3

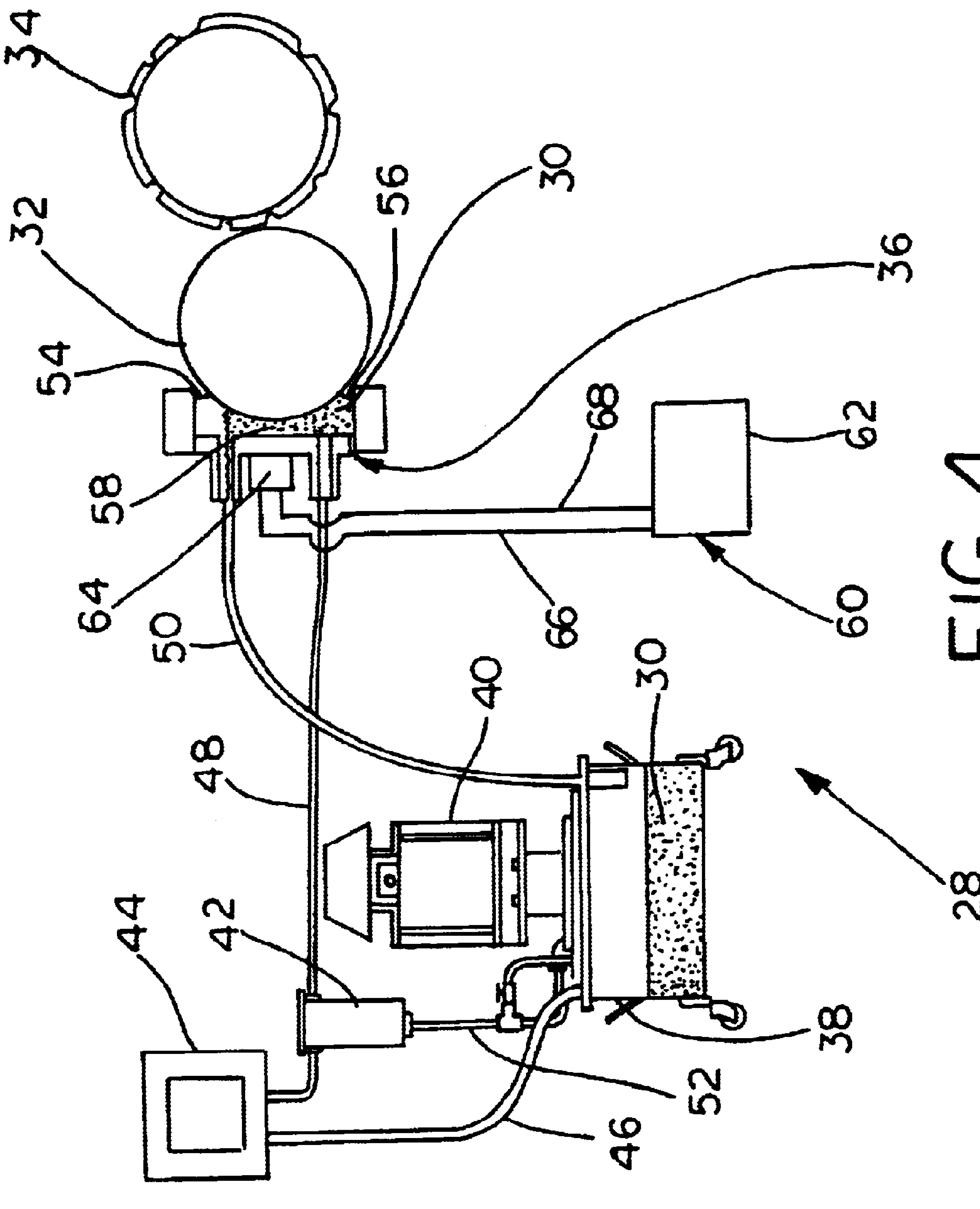


FIG. 4

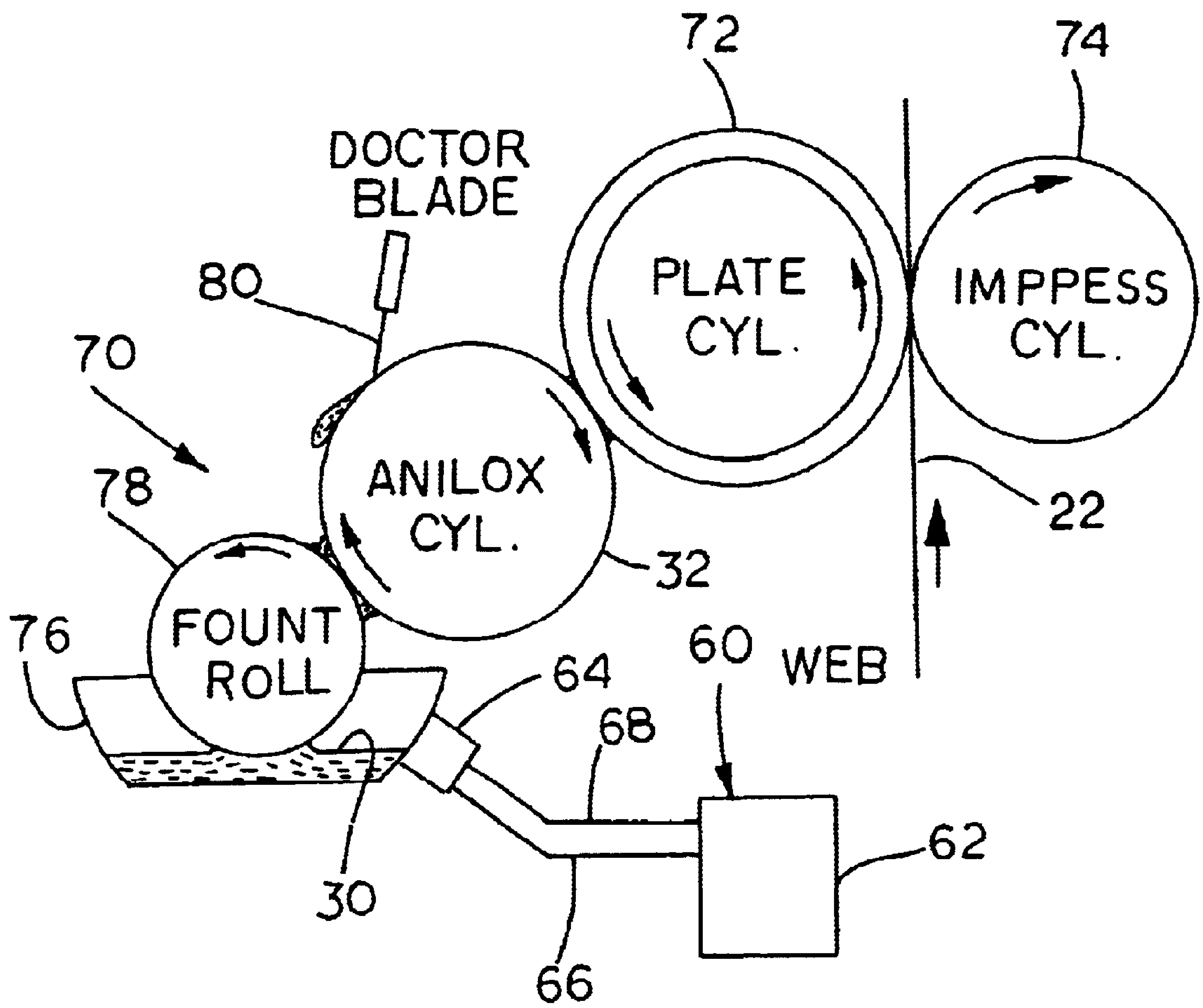

72
74
DOCTOR
BLADE
80
70
PLATE
CYL.
IMPPESS
CYL.
ANILOX
CYL.
78
32
22
FOUNT
ROLL
76
60
WEB
64
68
62
30
66

FIG. 5

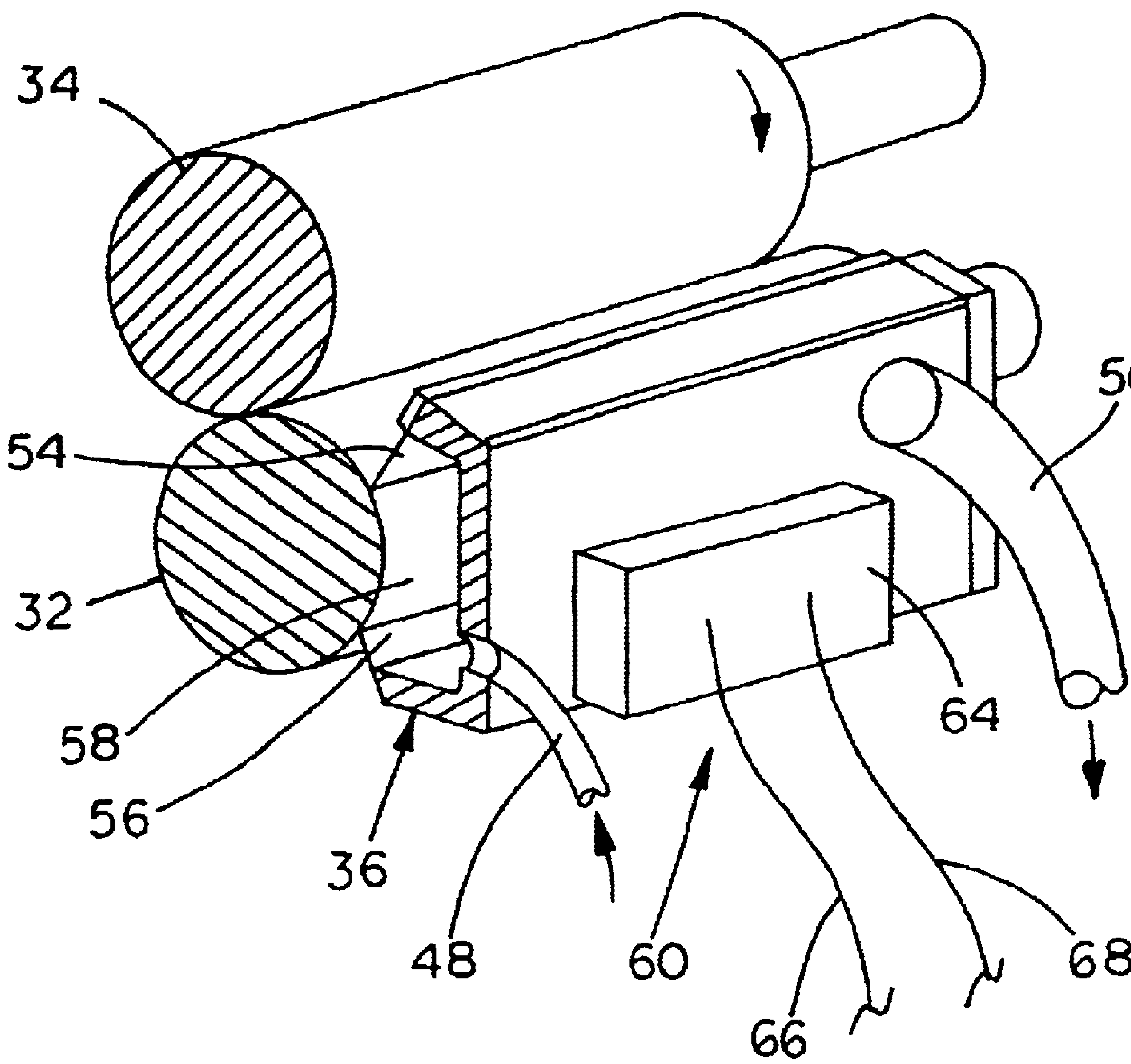


FIG.6

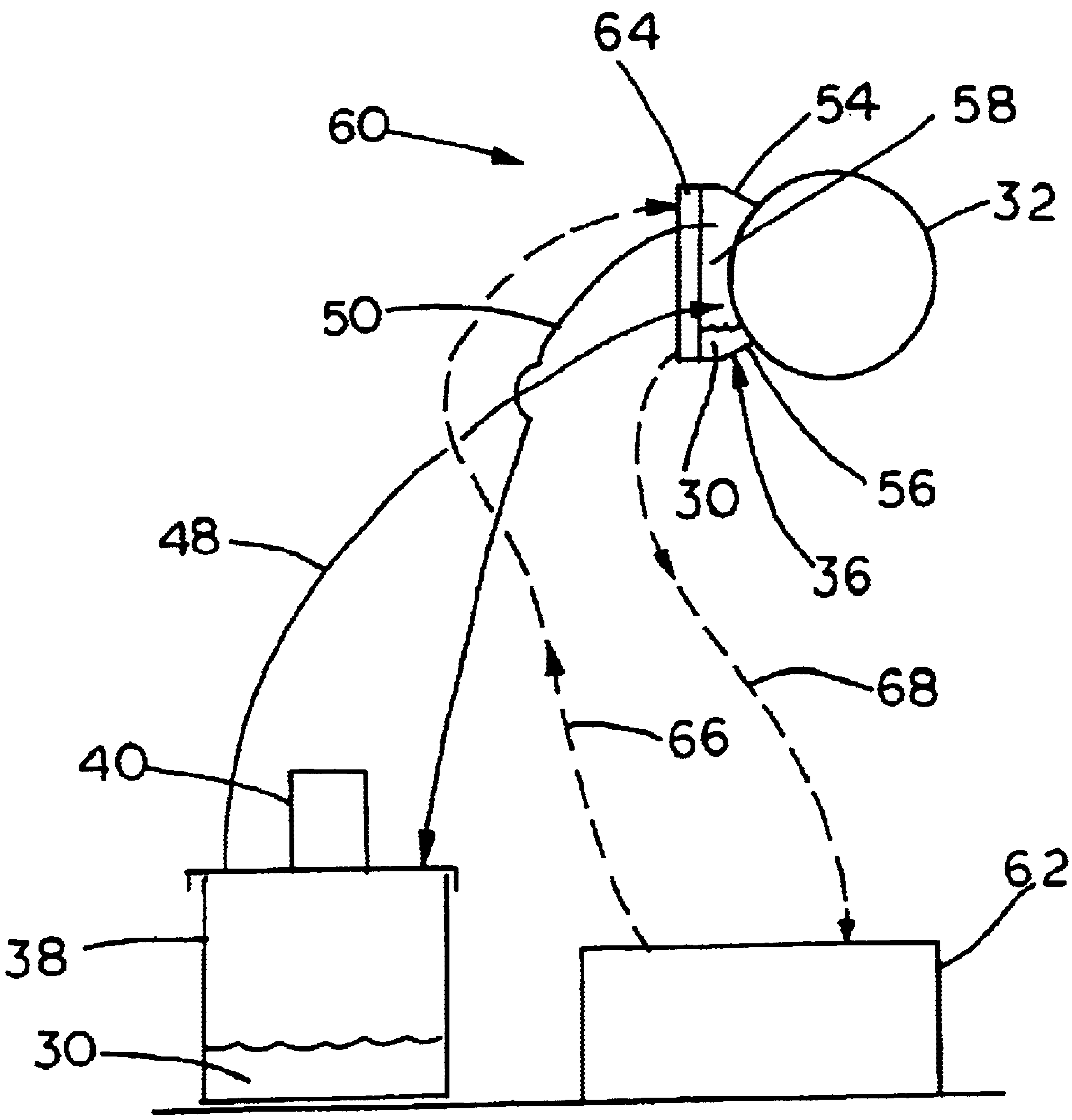


FIG. 7

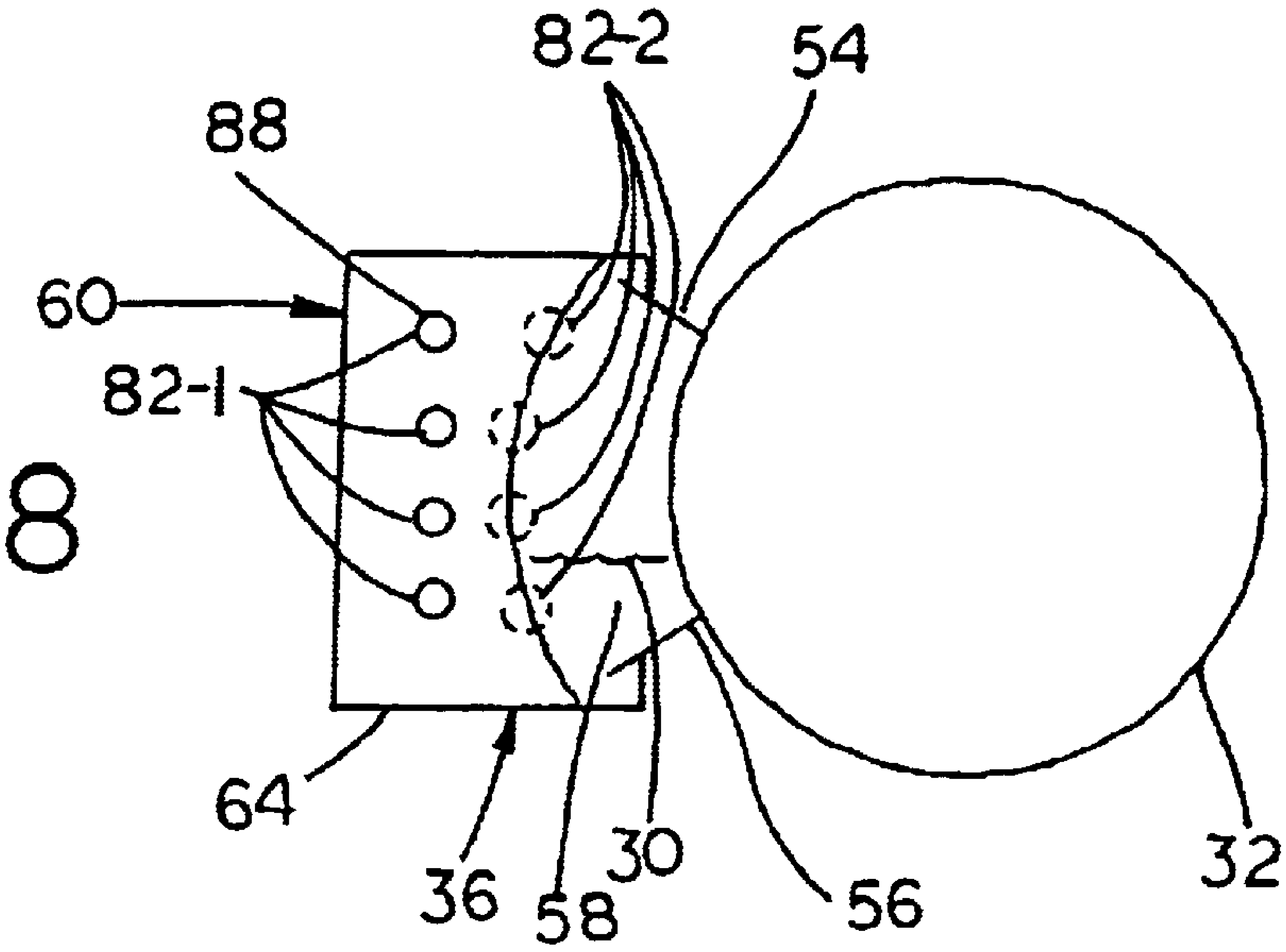


FIG.8

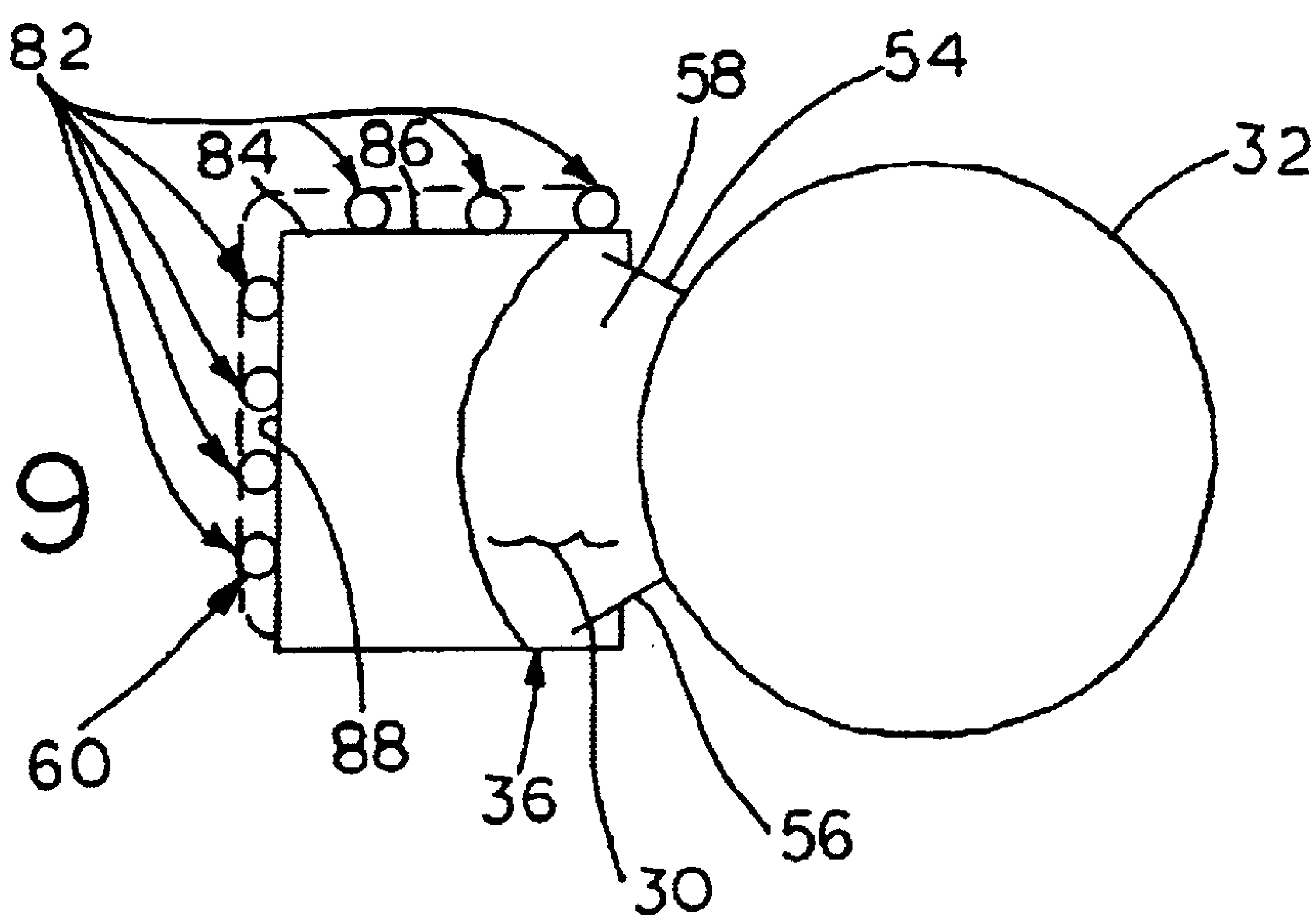


FIG.9

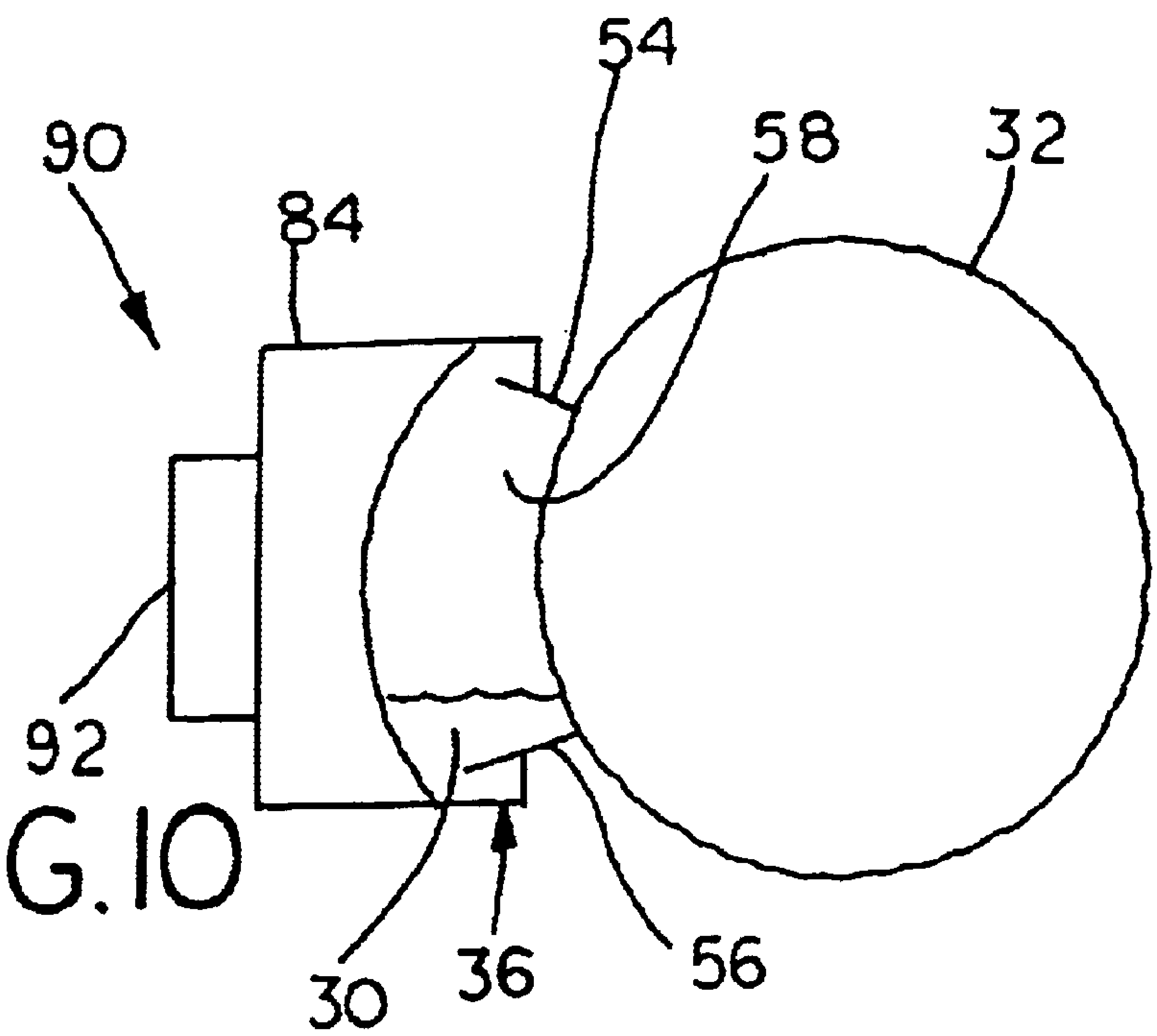


FIG.10

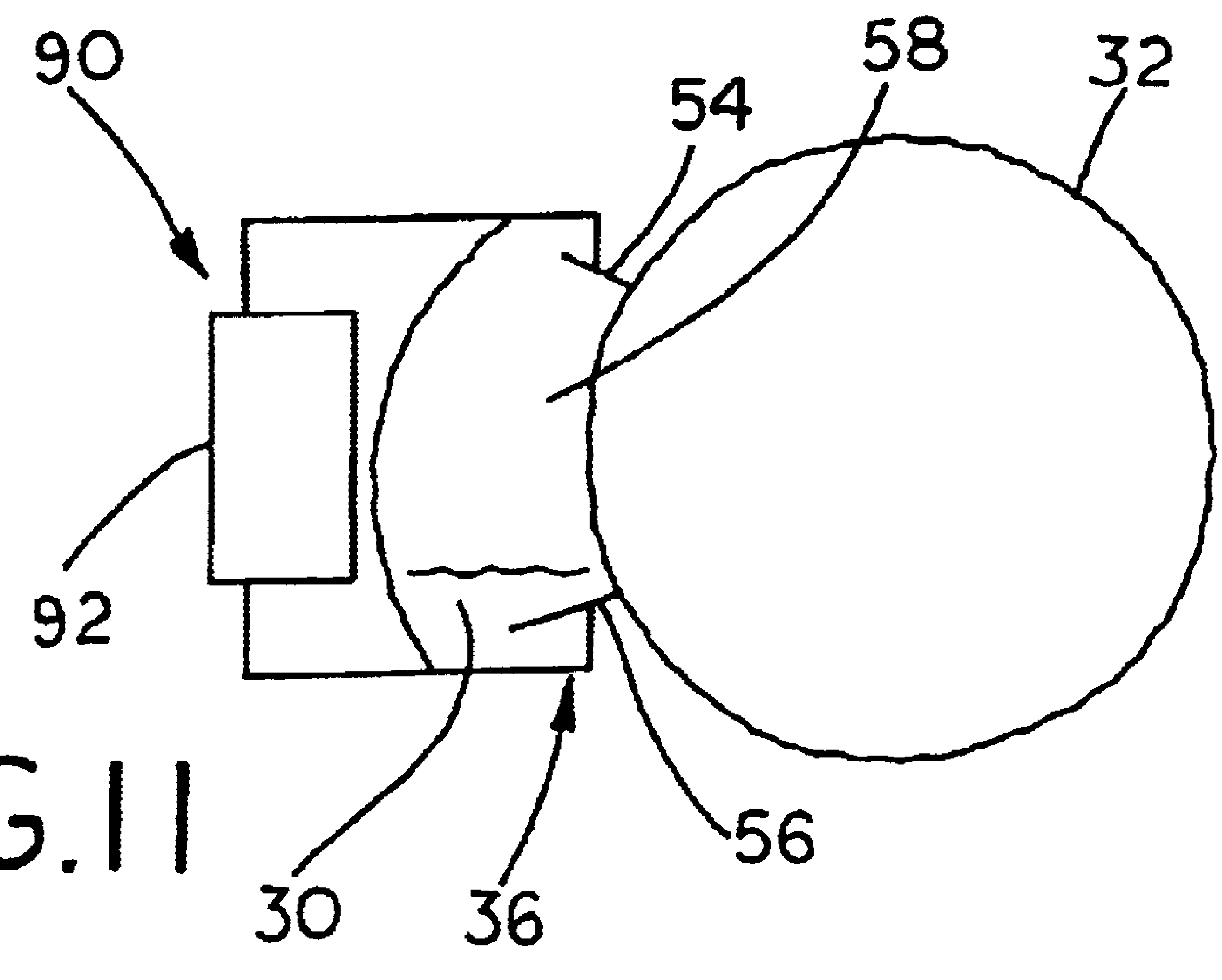


FIG.11

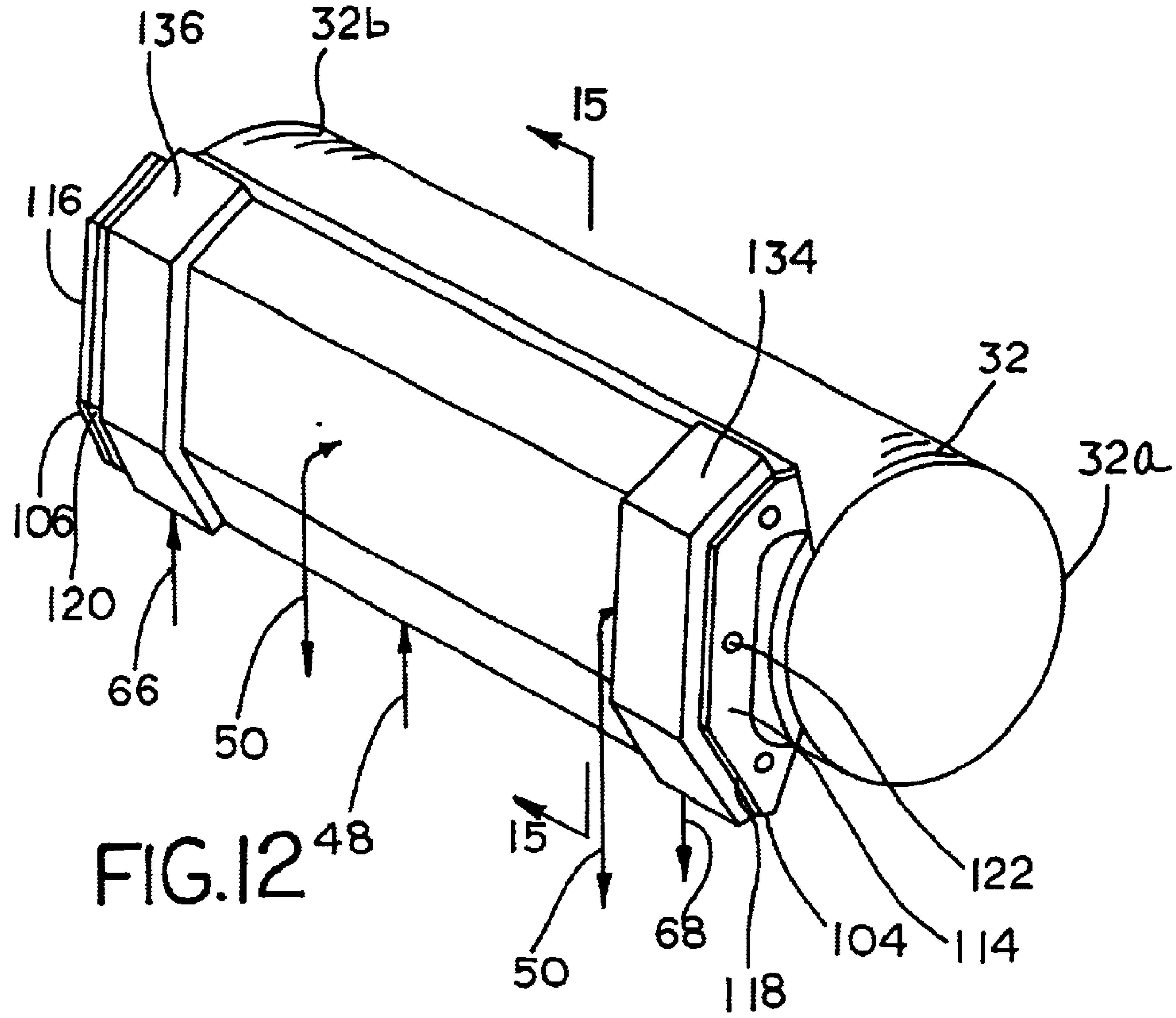

136
32b
15
116
134
32
32a
106
120
66
50
48
15
122
104
114
68
50
118

FIG.12

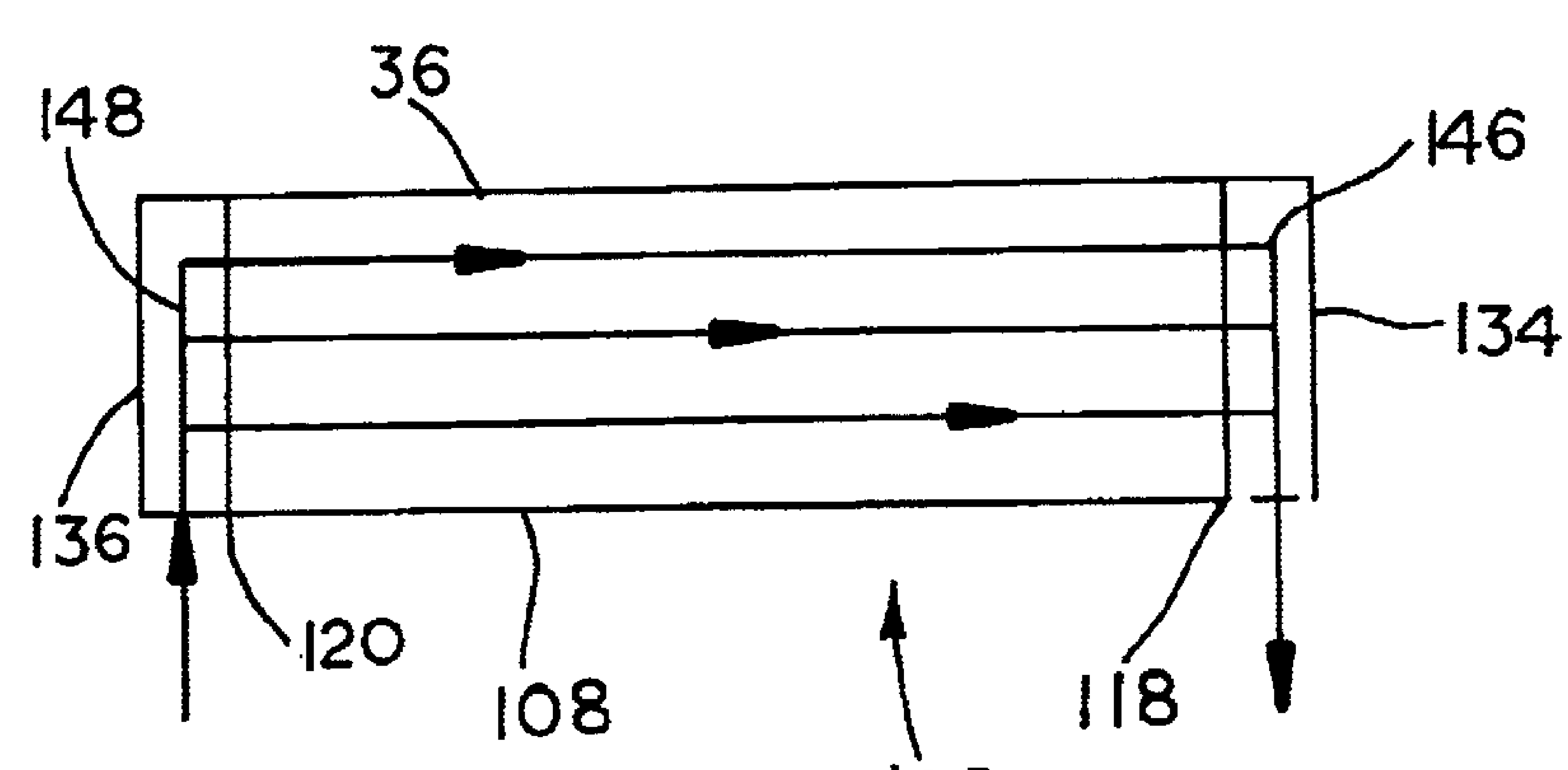

148
36
146
134
136
120
108
118
102

FIG.17

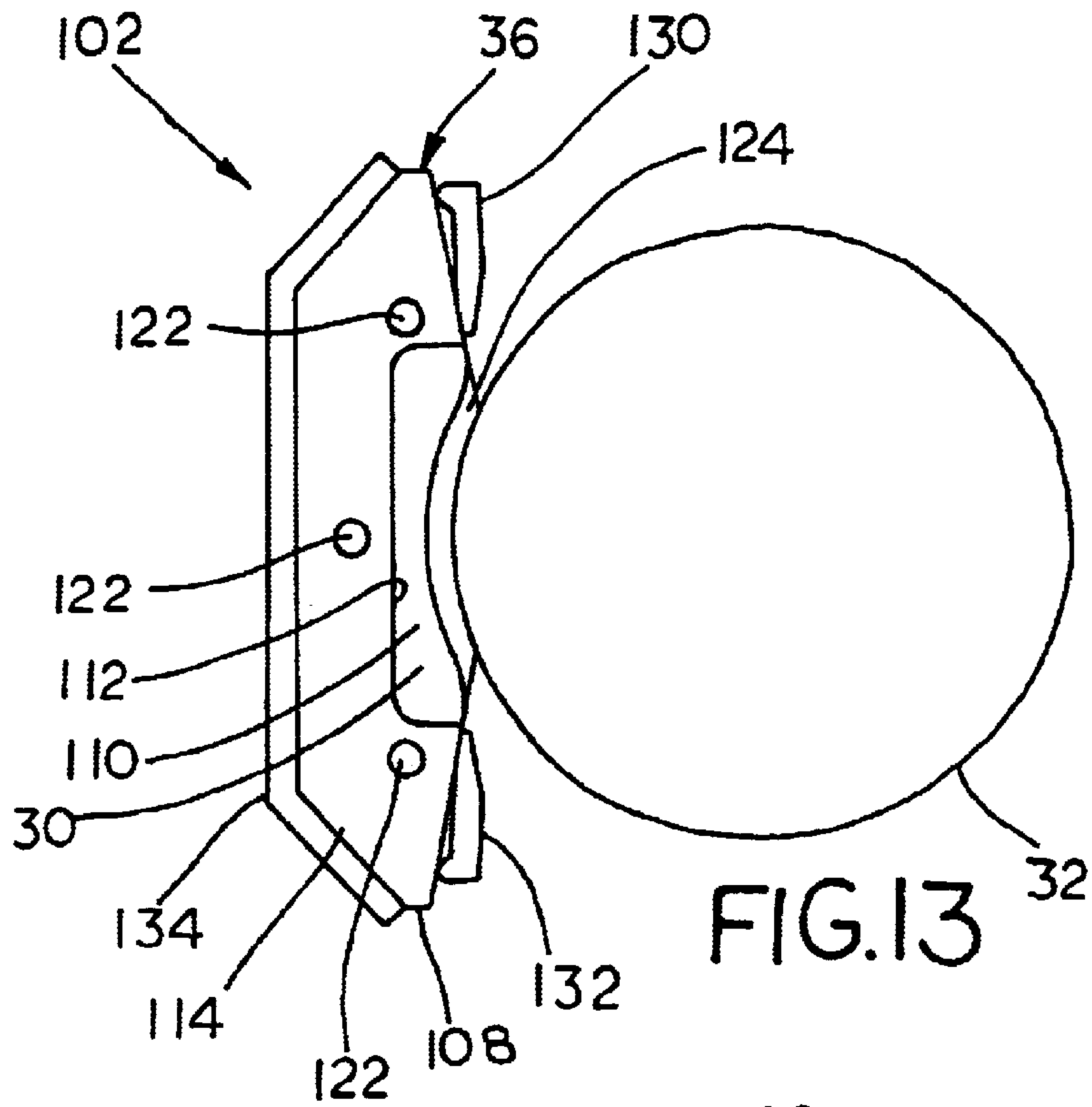

102
36
130
124
122
122
112
110
30
134
114
122
108
132
32

FIG. 13

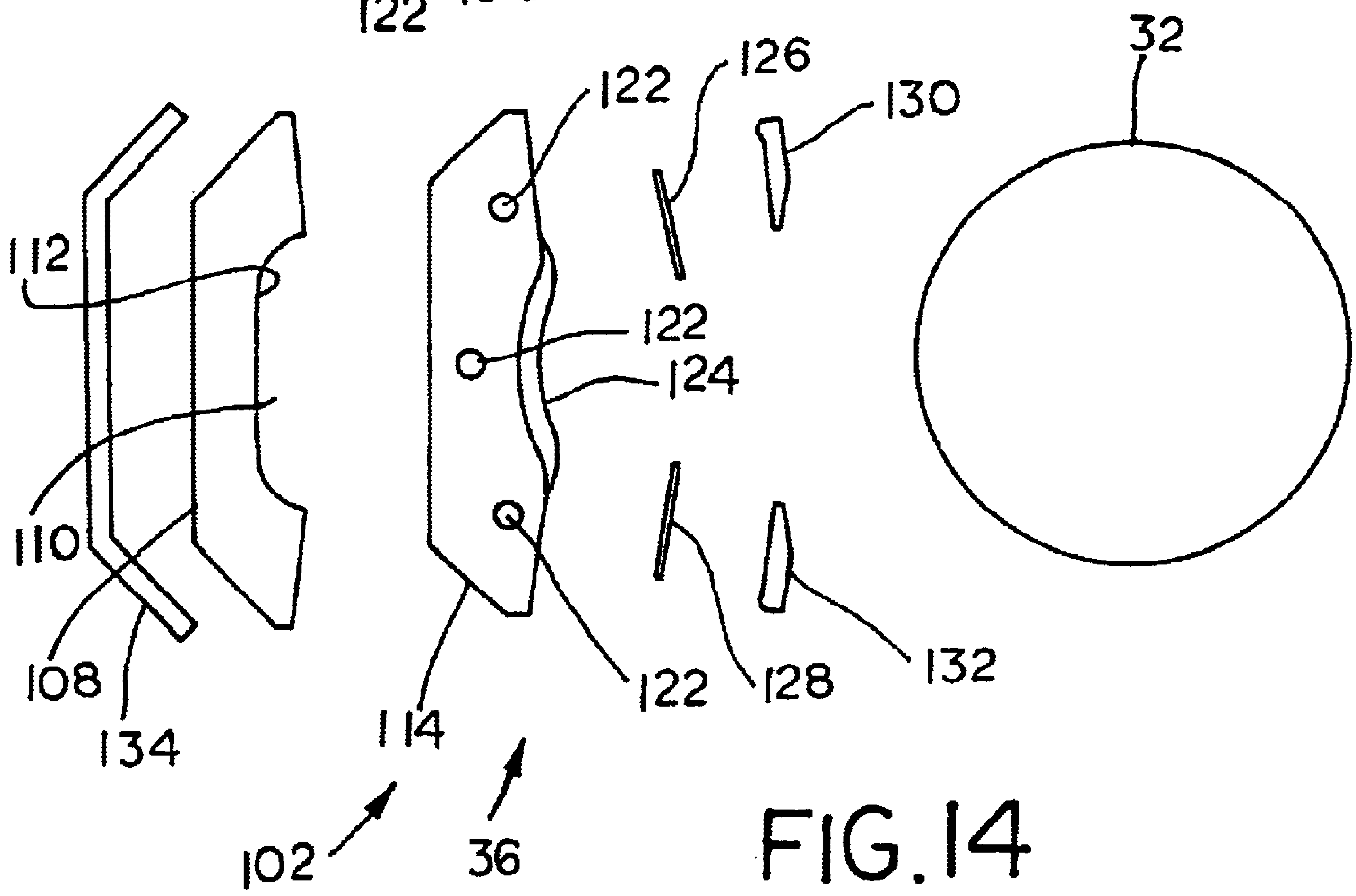

32
126
130
122
112
122
124
110
108
134
114
122
128
132
102
36

FIG. 14

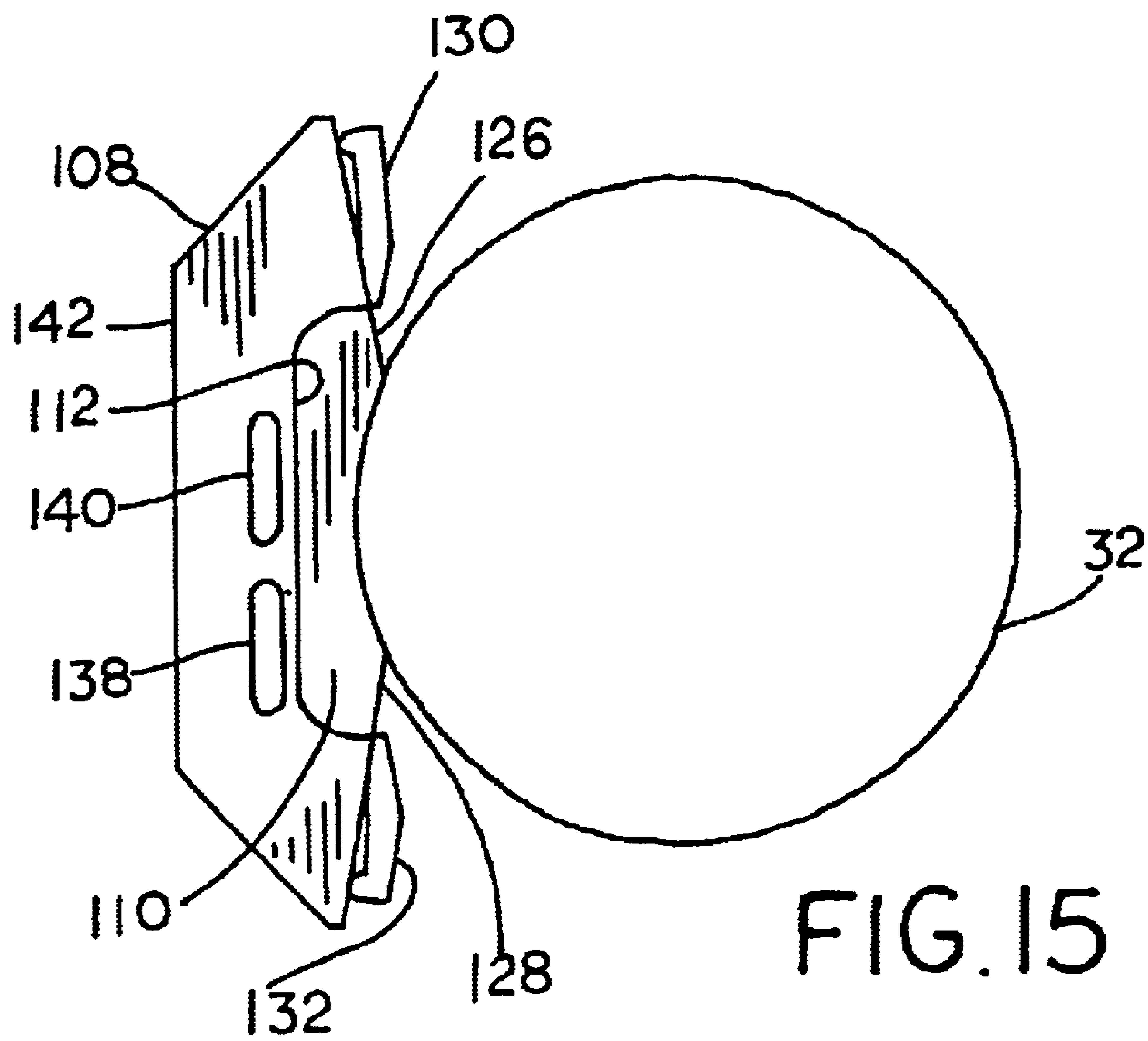

130
126
108
142
112
140
32
138
110
128
132

FIG.15

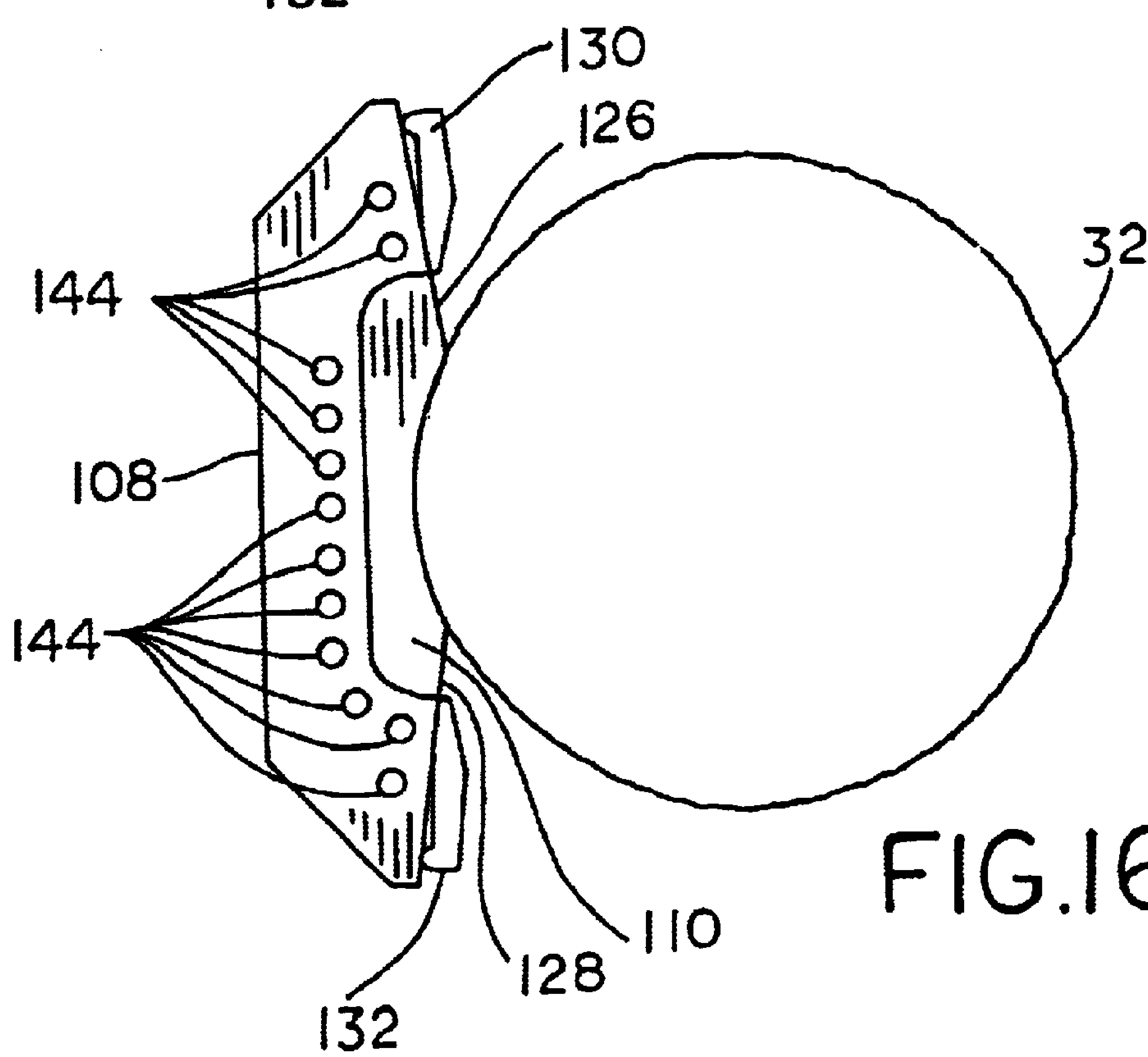

130
126
32
144
108
144
110
128
132

FIG.16

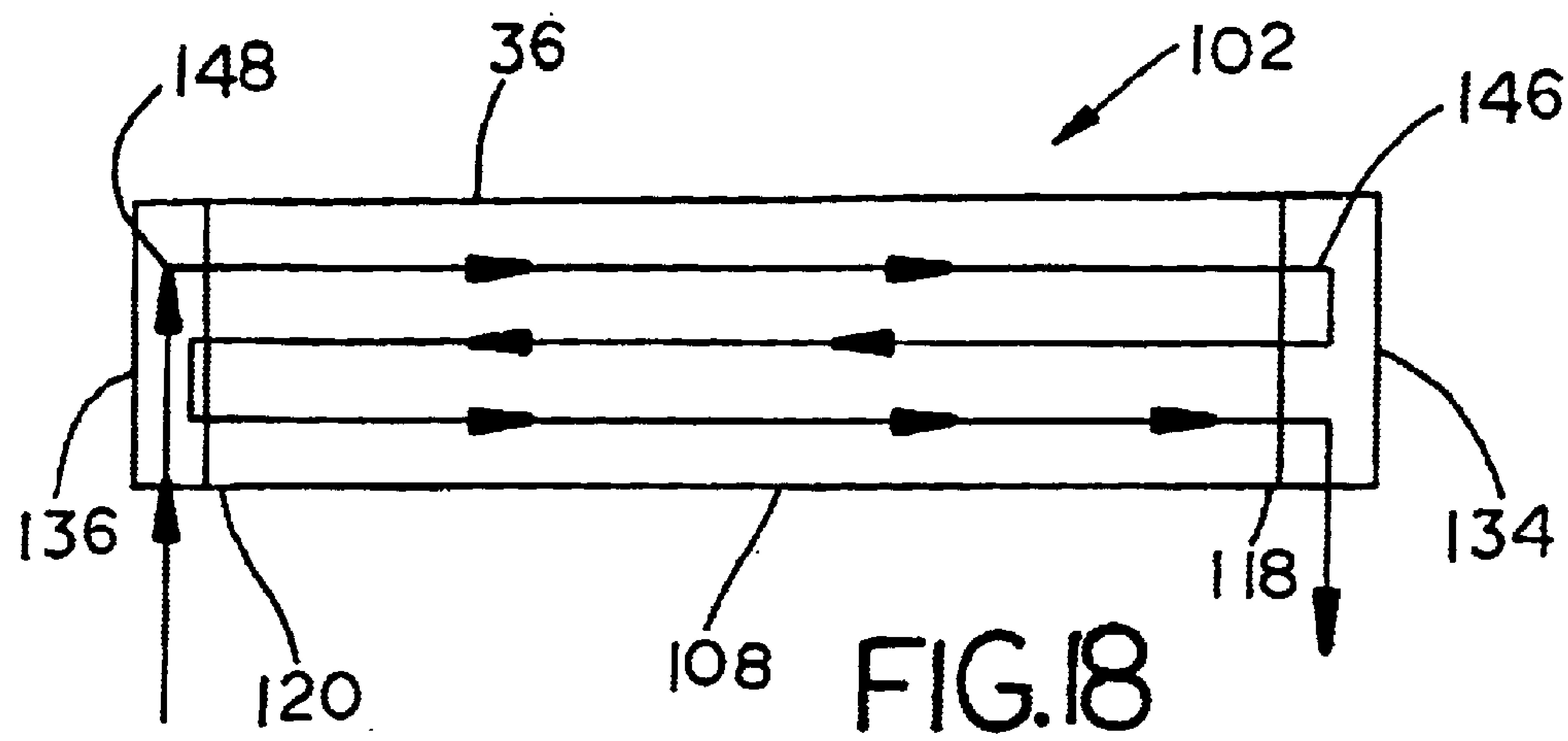


FIG.18

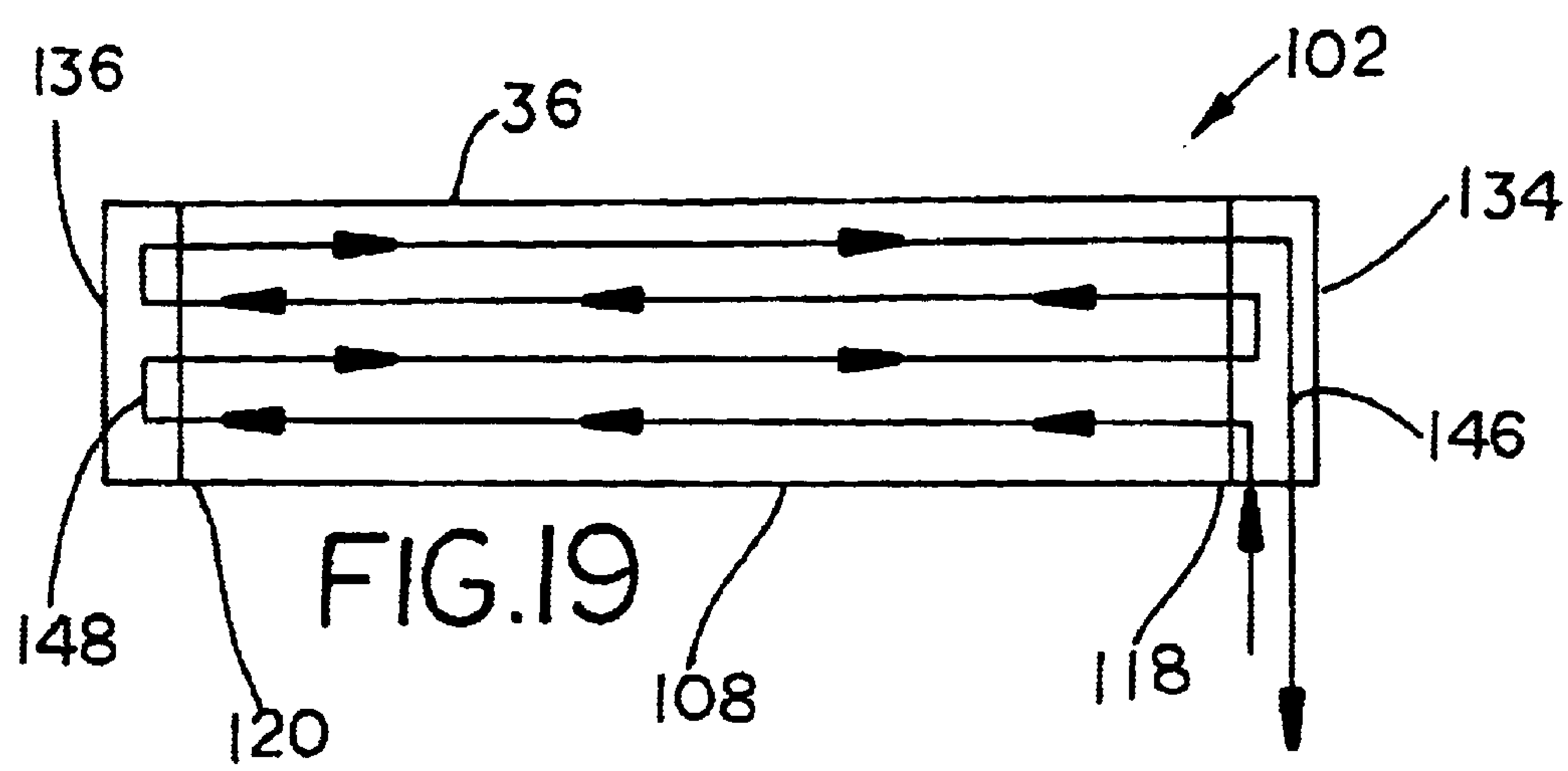


FIG.19

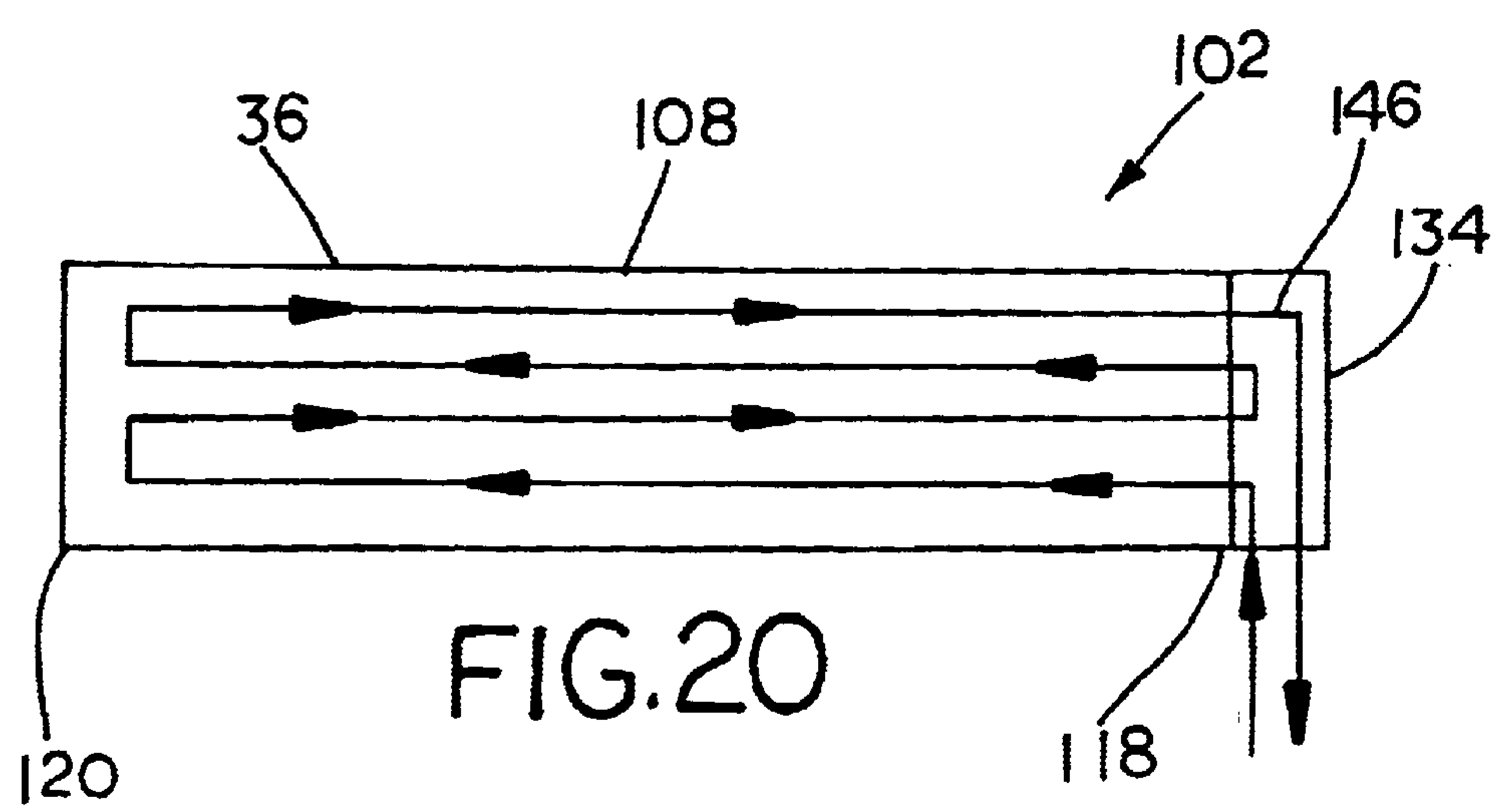


FIG.20

SYSTEM FOR COOLING INK AND OTHER LIQUIDS ON A PRINTING PRESS

RELATED APPLICATIONS

This application claims priority from U.S. provisional application Ser. No. 60/339,057, filed Oct. 30, 2001.

FIELD OF THE INVENTION

The present invention relates generally to printing presses and, more specifically, to a system for cooling ink and/or coatings on printing presses.

BACKGROUND OF THE INVENTION

It is known that the normal operation of a printing press produces heat. On many printing components, this heat may be the result of friction. For example, the anilox roll makes direct contact with the doctor blades in the chamber doctor blade system. Friction between the doctor blades and the anilox roll may cause one or more of these components to heat up. Further, friction between the anilox roll and other components, such as the plate cylinder, likewise may cause the anilox roll and other components to generate still additional heat. Still further heat is generated by plate rolls and other press components, such as, for example, dryers. Finally, additional heat may result from the ambient heat in the press room.

According to normal thermodynamic processes, the generated heat is readily transferred to the ink used on the printing press. In some press components, such as the aforementioned chamber doctor blade system, a relatively small quantity of ink may be exposed to a relatively high and localized heat source. Furthermore, the chamber or the pan may function as a heat sink, providing another avenue for routing heat to the ink.

As the ink heats up, various components of the ink may be lost, such as, by way of example rather than limitation, volatiles, solvents, amines, etc. Unfortunately, this heated and altered ink tends to have a detrimental effect on the overall quality of the printing operation. Additives and the labor or equipment required to correct the ink properties add additional expense. Accordingly, it may be desirable to cool the ink in order to prevent the negative impact on print quality. However, merely cooling the general ink supply is not sufficient to address the localized heating that occurs at some of the press components. The foregoing discussion may be equally applicable to coating systems which apply liquid coatings to a web or other substrate in a printing press.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of a six color flexographic common impression printing press;

FIG. **2** is an elevational view of a wide web stack type flexographic printing press;

FIG. **3** is an elevational view of a narrow web in-line flexographic printing press;

FIG. **4** is a schematic representation of a flexographic ink train system for supplying ink to the chamber doctor blade system on a printing press and also employing a localized ink cooling system assembled in accordance with the teachings of the present invention;

FIG. **5** is a fragmentary elevational view of a fountain roll for applying ink to an anilox roll and employing a single reverse angle doctor blade and also employing a localized ink cooling system assembled in accordance with the teachings of the present invention;

FIG. **6** is an enlarged fragmentary view in perspective of an enclosed doctor blade system for applying ink to an anilox roll and also employing a localized ink cooling system assembled in accordance with the teachings of the present invention;

FIG. **7** is a schematic illustration showing a system for supplying ink to an enclosed doctor blade system and also employing a localized ink cooling system assembled in accordance with the teachings of the present invention;

FIG. **8** is an enlarged fragmentary elevational view of an enclosed doctor blade system and illustrating a plurality of coolant supply tubes running through a portion of the enclosed chamber;

FIG. **9** is an enlarged fragmentary elevational view similar to FIG. **8** and illustrating a plurality of coolant supply tubes running around an external surface of the enclosed chamber;

FIG. **10** is an enlarged fragmentary elevational view similar to FIGS. **8** and **9** and illustrating an electronic cooling device mounted on an external surface of the enclosed chamber;

FIG. **11** is an enlarged fragmentary elevational view similar to FIG. **10** and illustrating an electronic cooling device mounted internally within the enclosed chamber;

FIG. **12** is a perspective view of a doctor blade system incorporating an ink cooling system assembled in accordance with the teachings of yet another disclosed example of the present invention;

FIG. **13** is an enlarged end view thereof;

FIG. **14** is an exploded view thereof;

FIG. **15** is a cross-sectional view taken along line **15—15** of FIG. **12** and incorporating a first type of coolant flow passages;

FIG. **16** is a cross-sectional view similar to FIG. **15** but incorporating a second type of coolant flow passages;

FIG. **17** is a schematic flow diagram illustrating the coolant flowing through the doctor blade system in a parallel flow arrangement;

FIG. **18** is another schematic flow diagram illustrating the coolant flowing through the doctor blade system in a counter flow arrangement;

FIG. **19** is yet another schematic flow diagram illustrating the coolant flowing through the doctor blade system in another flow arrangement; and

FIG. **20** is a still further schematic flow diagram illustrating the coolant flowing through the doctor blade system in another counter flow arrangement employing only a single header;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The examples described herein are not intended to be exhaustive or to limit the scope of the invention to the precise form or forms disclosed. Rather, the following exemplary embodiments have been chosen and described in order to best explain the principles of the invention and to enable others skilled in the art to follow the teachings thereof.

Referring now to FIG. **1** of the drawings, a six color flexographic common impression printing press of the type commonly known in the art is referred to by the reference numeral **20**. It will be understood that the teachings of the present invention may be equally applicable to other types of printing presses in addition to those presses specifically mentioned herein. The press **20** typically includes a plurality of printing stations, for example **20-1** through **20-6**, for applying ink to a web **22**. As would be known, each of the printing stations **20-1** through **20-6** includes a system for applying ink to an anilox roll, such as a doctor blade system (FIGS. **4** and **6** through **11**), or a fountain pan system (FIG. **5**), which are discussed in greater detail below. Each station **20-1** through **20-6**, as well as the press **20**, also include a plurality of other components, all of which may be conventional and would be known to those of skill in the art.

Referring now to FIG. **2** of the drawings, a wide web stack type flexographic printing press of the type commonly known in the art is referred to by the reference numeral **24**. The press **24** typically includes a plurality of printing stations, for example **24-1** through **24-4**, for applying ink to the web **22**. As would be known, each of the printing stations **24-1** through **24-4** includes a system for applying ink to an anilox roll. Again, such a system may comprise a doctor blade system (FIGS. **4** and **6** through **11**), or a fountain pan system (FIG. **5**). Each station **24-1** through **24-4** as well as the press **24** includes a plurality of other components, all of which may be conventional and would be known to those of skill in the art.

Referring now to FIG. **3** of the drawings, a narrow web in-line flexographic printing press of the type commonly known in the art is referred to by the reference numeral **26**. The press **26** typically includes a plurality of printing stations, for example **26-1** through **26-4**, for applying ink to the web **22**. As would be known, each of the printing stations **26-1** through **26-4** includes a system for applying ink to an anilox roll. Again, such a system may comprise a doctor blade system (FIGS. **4** and **6** through **11**), or a fountain pan system (FIG. **5**). Each station **26-1** through **26-4** as well as the press **26** includes a plurality of other components, all of which may be conventional and would be known to those of skill in the art. Again, the above-identified presses **20**, **24** and **26** are mentioned herein for purposes of illustration only. The use of other types of presses may be contemplated. For the sake of convenience, the following discussion will refer only to the press **20**. It will be understood that the teachings described herein may be equally applicable to each of the aforementioned presses **20**, **24**, **26**, and to any flexographic, gravure, and/or offset lithographic presses. Further, it will be understood that the teachings described herein may be applicable to other systems and/or methods of applying inks, coatings, and/or other materials to a substrate.

Referring now to FIGS. **4**, **6** and **7**, a flexographic ink train system **28** is used to apply ink **30** to an anilox roll **32** on the press **20**, for subsequent application to a plate cylinder **34** (FIGS. **4** and **6**). As outlined above, the system **28** may be equally applicable to any one of the presses **20**, **24**, **26** mentioned above. The system **28** includes an enclosed chamber doctor blade system **36**, an ink tank **38**, a pump **40**, a filter **42**, and a viscosity controller **44**. A plurality of lines **46**, **48**, **50**, and **52** are provided for routing to the ink **30** to and between the various components. The doctor blade system **36** includes a pair of doctor blades **54**, **56** as would be known, and further includes a chamber **58** which contains a quantity of the ink **30**. The ink **30** is supplied to the doctor blade system **36** via the line **48**, and is returned through the line **50** to the ink tank **38** in a conventional manner.

The system **28** is provided with an ink cooling system **60** assembled in accordance with the teachings of a first disclosed example of the present invention. The system **60** includes a refrigeration unit **62** and an exchange unit **64**. The exchange unit **64** is mounted to the chamber **58** so as to cool the ink **30** disposed within the chamber **58**. A supply line **66** routes a refrigerant (which may be any one of a number of commercially available refrigerants) or other coolant medium, such as chilled water, to the exchange unit **64**, and a return line **68** returns the refrigerant to the refrigeration unit **62**. The cooling operation carried out by the refrigeration unit **62** and the exchange unit **64** may be conventional using well known refrigeration/cooling principles. It will be understood that the refrigeration unit **62** will typically include a pump, a compressor, an expansion valve, etc., and other conventional components (not shown) as would be known. It will be understood that the aforementioned components may also be applied to a system for applying coatings to a web or other substrate in order to cool the coating material in a similar manner.

Referring now to FIG. **5**, a fountain roll system **70** for applying the ink **30** to the anilox roll **32** is shown. Also shown are a plate cylinder **72** and an impression cylinder **74**, which cooperate to apply the ink **30** to the web **22** in a conventional manner. The fountain roll system **70** includes an ink pan **76** and a fountain roll **78** which rotates in the ink pan **76** so as to pick up a quantity of the ink **30** contained therein for transfer to the anilox roll **32**. The fountain roll system **70** also includes one or more doctor blades, with a single reverse angle doctor blade **80** shown.

The system **70** also includes the ink cooling system **60** similar to that outlined above. The exchange unit **64** is mounted to the ink pan **76** so as to cool the ink **30** disposed within the ink pan **76**. The supply line **66** and the return line **68** route the refrigerant between the exchange unit **64** and the refrigeration unit **62**. Again, the cooling operation carried out by the refrigeration unit **62** and the exchange unit **64** may be conventional using well known refrigeration/cooling principles.

The exchange unit **64** may take a number of forms. For example, referring now to FIG. **8**, the exchange unit **64** shown therein includes a plurality of cooling chambers or tubes **82** which are routed through the chamber **58** of the doctor blade system **36**. The cooling tubes **82** include a first set of cooling tubes **82-1** and a second set of cooling tubes **82-2**. The cooling tubes **82** may include enhanced surface features, such as fins, plate-fins, and/or other structures or surface treatments, to enhance the heat exchange effect. The second set of cooling tubes **82-2** are shown running through the chamber **58** so as to come into direct contact with at least a portion of the ink **30** disposed within the chamber **58**.

Referring now to FIG. **9**, the exchange unit **64** shown therein includes a plurality of cooling chamber or tubes **82** which are routed along an exterior portion **84** of the chamber **58** of the doctor blade system **36**. The cooling tubes **82** may run in contact with a number of exterior surfaces, for example the surfaces **86** and **88**, in order to cool the ink **30** housed within the chamber **58**. An insulating, protective, or restraining covering (shown in dotted lines) may be placed over the tubes.

Referring now to FIGS. **10** and **11**, an electronic cooling system **90** may be provided in place of, or in addition to, the more conventional refrigerant-based cooling system outlined above. In the embodiment of FIGS. **10** and **11**, an electronic cooling component **92** is mounted to the exterior portion **84** of the doctor blade system **36** (FIG. **10**), or, as an alternative, the cooling component **92** may be mounted to the doctor blade system **36** so as to extend into the chamber **58** so as to come into direct contact with at least a portion of the ink **30** housed therein. The electronic cooling component **92** may be a thermoelectric cooling device employing what is known as “the Peltier Effect”. Such a cooling component **92** is a solid-state method of heat transfer through dissimilar semiconductor materials. Such electronic cooling components **92** are commercially available. One possible source is ThermoElectric Cooling America of Chicago, Ill. As is known, an electronic cooling system replaces the main working components of a conventional refrigerant-based system with a cold junction, a heat sink and a DC power source. The refrigerant in both liquid and vapor form is replaced by two dissimilar conductors. The cold junction (evaporator surface) becomes cold through absorption of energy by the electrons as they pass from one semiconductor to another, instead of energy absorption by the refrigerant as it changes from liquid to vapor. The compressor is replaced by a DC power source which pumps the electrons from one semiconductor to another. A heat sink replaces the conventional condenser fins, discharging the accumulated heat energy from the system.

Referring now to FIG. **12**, an ink cooling system assembled in accordance with the teachings of yet another disclosed example of the present invention is shown and is generally referred to by the reference numeral **102**. The ink cooling system **102** is shown in conjunction with the anilox roll **32**, and the ink cooling system **102** is operatively connected to the ink train system **28** of the type discussed above with respect to the earlier disclosed examples. It will be understood that the ink train system **28** (not shown in FIG. **12**), includes an ink supply line **48**, and an ink return line **50** which operate to route the ink **30** from the ink tank (not shown) in a manner similar to that discussed above (which may be similar or identical to the same elements as discussed above with respect to the earlier disclosed examples).

The ink cooling system **102** is incorporated into a doctor blade system, such as the doctor blade system **36** discussed above with respect to the earlier disclosed examples. It will be appreciated that the doctor blade system **36** extends essentially along a length of the anilox roll **32** such that the doctor blade system includes a first end **104** and a second end **106** which are disposed generally adjacent to opposing ends **32***a* and **32***b*, respectively of the anilox roll.

Referring now to FIGS. **13** and **14**, the doctor blade system **36** is shown adjacent to the anilox roll **32**. The doctor blade system **36** includes a housing **108** which defines an ink cavity **110**. The ink cavity **110** is arranged to contain a quantity of the ink **30** between interior wall **112** of the housing **108** and the anilox roll **32**. The doctor blade system **36** includes a pair of end caps **114**, **116** (the end cap **116** is visible in FIG. **12** only). The end cap **114** is mounted to an end **118** of the housing **108** while the end cap **116** is mounted to an end **120** of the housing **108**. Each end cap **114**, **116** is secured to the housing **108** using a plurality of attachment bolts **122**. Each end cap **114**, **116** includes a seal **124**, which preferable is a compressible seal of the type commonly employed in the art and which abuts the anilox roll **32** in a known manner in order to seal the ends of the cavity **110**.

The doctor blade system **36** also includes an upper blade **126** and a lower blade **128**, both of which extend generally along the length of the housing **108**. Each blade **126**, **128** includes a hold down bar **130**, **132**.

Referring again to FIG. **12**, the doctor blade system **36** is operatively connected to the ink supply line **48**, and may include one or more ink return lines **50**. The ink cooling system **102** is also connected to the coolant supply line **66** and the coolant return line **68**, both of which are operatively connected to a refrigeration unit (not shown, but which may be similar to the regrigeration unit discussed above with respect to the earlier disclosed examples), or to any other refrigeration unit capable of supplying a suitable coolant medium to the ink cooling system **102**.

Preferably, the housing **108** is provided with a pair of headers **134**, **136** (the header **136** is visible in FIG. **12** and schematically in FIGS. **17**–**19**). The headers **134**, **136** are disposed generally adjacent to the ends **118**, **120**, respectively of the housing **108**. In the example shown, the coolant supply line **66** is routed to the header **136**, while the coolant return line **68** is routed to the header **134**.

Referring now to FIG. **15**, the housing **108** includes a pair of internal flow passages **138**, **140**. The flow passages **138**, **140** are defined in the cross section of the housing **108**, generally between the interior wall **112** of the housing **108** and an exterior wall **142** of the housing **108**. The coolant flow passages **138**, **140** are in flow communication with the coolant supply and return lines **66**, **68**, such that the coolant entering the coolant supply line **66** will flow through the housing **108** via the passages **138**, **140** and exit the housing **108** via the coolant return line **68**. Thus, in accordance with the disclosed example, the ink **30** contained within the ink cavity **110** of the housing **108**, which ink **30** may be warmer than is desired, will be cooled via heat transfer taking place between the warmer ink **30** and the coolant contained in the flow passages **138**, **140**.

Referring now to FIG. **16**, the housing **108** shown therein is equipped with a plurality of coolant flow passages **144**, which are greater in number than the pair of flow passages **138**, **140** as discussed with respect to FIG. **15**. Other than the difference in the number of flow passages, the construction and operation of the ink cooling system **102** illustrated in FIG. **16** may be substantially similar to the structure and operation of the ink cooling system **102** shown in FIG. **15**. With regard to both FIGS. **15** and **16**, it will be appreciated that the housing **108** may be supplied with suitable ports or connections in order to route the coolant contained in the appropriate coolant flow passages from the appropriate ends of the housing **108** to the adjacent headers **134**, **136** and thus to the coolant supply or return lines **66**, **68**. Also, in accordance with the disclosed example, the housing **108** shown in either FIG. **15** or **16** may be constructed of, for example, extruded or cast aluminum, or any other suitable material.

Referring now to FIGS. **17**–**20**, it will be appreciated that the ink cooling system **102** may be readily adaptable to utilize either a parallel flow arrangement (FIG. **17**) or a counter flow arrangement (FIGS. **18**–**20**). It will further be appreciated that the ink cooling system may be provided with only a single header **134** at the end **118** of the housing **108**, or alternatively, the ink cooling system **102** may incorporate the pair of headers **134**, **136**. A single flow path (FIGS. **18**–**20**) or multiple flow paths (FIG. **17**) may be provided. It will also be appreciated that the coolant supply line **66** and the coolant return line **68** may be in flow communication with the headers **134**, **136** (FIGS. **17** and **18**), or, as an alternative, the coolant supply line **66** and the coolant return line **68** may be in flow communication with only a single one of the headers, for example the header **134** illustrated in FIGS. **19** and **20**.

In the disclosed examples, it will be understood that the headers **134** may be provided with suitable passages or ports **146**, while the headers **136** may be provided with suitable passages or ports **148**, in order to be in flow communication with the coolant flow passages **138**, **140**, or **144**. Additionally, the passages may be internally interconnected, with such an example shown schematically in FIG. **20** adjacent the end **120**.

In accordance with one or more of the disclosed examples, the doctor blade system **36** including the ink chamber typically extends along all or major portion of the length of the anilox roll **32**. It is known that in many commercial applications the anilox roll **32** may be, for example, between about 4 feet and 8 feet in length. Typically, the end caps **114, 116** measure, for example, about one half inches thick. Typically, the seals **124** are formed of a foam-like material that is sandwiched between the appropriate end cap **114, 116** and the adjacent ends of the chamber **118, 120**, respectively. The seals **124** are also held in place by the hold down bars **130, 132**, which hold the doctor blades **126, 128** in place. The seals **124** are compressed against the surface of the anilox roll **32** and thus seal the ends of the ink chamber.

The anilox roll **32** typically has millions of cells. As the anilox roll **32** rotates, the cells rotate through the ink **30** contained within the chamber such that the cells fill with ink. Along the length of the anilox roll the blades **126, 128** act as seals to seal the chamber along the length of the anilox roll **32**, and also scrape off any excess ink, thus leaving only what is contained in the cells for application to the raised image on the next cylinder (not shown) which is typically disposed on the opposite side of the anilox roll **32**.

Although certain apparatus constructed in accordance with the teachings of the invention have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all embodiments of the teachings of the invention fairly falling within the scope of the appended claims either literally or under the doctrine of equivalence.

What is claimed:

1. A doctor blade system for use on a printing press and having an integrated cooling system comprising:

an elongated doctor blade housing, the housing having a first end and a second end and defining a cavity arranged to contain a quantity of ink;

the housing including a plurality of coolant passages, the coolant passages defining a coolant flow path extending between the first end and the second end, at least a portion of the coolant flow passages including a surface area in conductive heat transfer relationship with the cavity; and

the housing further including a coolant inlet and a coolant outlet, the inlet and the outlet in flow communication with the path and disposed at opposite ends of the path, the coolant inlet adapted for flow communication with a coolant supply, the coolant outlet adapted for flow communication with a coolant return.

2. The device of claim **1**, wherein the housing includes a top wall, a bottom wall, and a side wall, and wherein the coolant passages are defined in at least one of the top wall, the bottom wall and the side wall.

3. The device of claim **1**, wherein the housing includes at least one wall having a cross section and abutting at least a portion of the cavity, and wherein at least some of the coolant passages are defined in the cross section.

4. The device of claim **1**, wherein the housing includes a sidewall, and wherein at least some of the coolant passages are integrally formed in the sidewall.

5. The device of claim **4**, wherein the housing comprises an extruded aluminum member.

6. The device of claim **4**, wherein the housing comprises a cast member.

7. The device of claim **1**, including a first header attached to the first end of the housing and a second header attached to the second end of the housing, and wherein a portion of the flow path proceeds through each of the first and second headers.

8. The device of claim **7**, wherein the coolant inlet is defined in the first header and the coolant outlet is defined in the second header.

9. The device of claim **7**, wherein the coolant inlet and the coolant outlet are defined are both defined in either the first header or the second header.

10. The device of claim **1**, wherein the coolant passages are arranged to define a plurality of flow paths between the first end and the second end of the housing.

11. The device of claim **7**, wherein the first header and the second header include a plurality of ports, each port providing flow communication between at least two of the coolant passages.

12. The device of claim **7**, wherein the first and second headers include a plurality of ports, the ports arranged to provide flow communication between the first end of the housing and the second end of the housing in only a single direction.

13. The device of claim **7**, wherein the first and second headers include a plurality of ports, the ports arranged to provide flow communication between the first end of the housing and the second end of the housing in a first direction and in a second direction.

14. The device of claim **7**, wherein the first and second headers include a plurality of ports, the ports arranged to provide flow communication through only a selected number of the coolant passages.

15. The device of claim **7**, wherein the first and second headers include a plurality of ports, the ports arranged to provide flow communication through only a selected number of the coolant passages.

16. The device of claim **1**, in combination with a cooling unit having a coolant supply and a coolant return, the cooling unit arranged to receive and cool a coolant medium and to communicate the coolant medium to and from the housing.

17. A doctor blade system for use on a printing press and having an integrated cooling system comprising:

a doctor blade housing, the housing having a first end and a second end and defining a cavity arranged to contain a quantity of ink;

the housing having a cross-section defining a plurality of coolant passages integrally formed along a length of the housing, the coolant passages defining a coolant flow path extending between the first end and the second end, at least a portion of the coolant flow passages in conductive heat transfer relationship with a cooling surface area, the cooling surface area exposed to the cavity;

a cooling unit having a supply of coolant medium, the cooling unit having a coolant supply and a coolant return; and

the housing including a coolant inlet in flow communication with the coolant supply and a coolant outlet in flow communication with the coolant return.

18. The device of claim **17**, wherein the housing includes a wall extending between the first end and the second end, and wherein the coolant passages are internally formed in the wall.

19. The device of claim **17**, wherein the housing comprises an extruded aluminum member.

20. The device of claim **17**, wherein the housing comprises a cast member.

21. The device of claim **17**, including a first header attached to the first end of the housing and a second header attached to the second end of the housing, and wherein a portion of the flow path proceeds through each of the first and second headers.

22. The device of claim **17**, wherein the coolant inlet is defined in the first header and the coolant outlet is defined in the second header.

23. The device of claim **17**, wherein the coolant inlet and the coolant outlet are defined are both defined in either the first header or the second header.

24. The device of claim **17**, including a first header attached to the first end of the housing and a second header attached to the second end of the housing, and wherein the coolant passages are arranged to define a plurality of flow paths between the first and the second end of the housing.

25. The device of claim **24**, wherein the plurality of flow paths proceed in the same direction.

26. The device of claim **24**, wherein a first one of the flow paths proceeds in a first direction and a second one of the flow paths proceeds in a second direction opposite to the first direction.

27. The device of claim **21**, wherein the first header and the second header include a plurality of ports, each port providing flow communication between at least two of the coolant passages.

28. The device of claim **21**, wherein the first and second headers include a plurality of ports, the ports arranged to provide flow communication between the first end of the housing and the second end of the housing in only a single direction.

29. The device of claim **21**, wherein the first and second headers include a plurality of ports, the ports arranged to provide flow communication between the first end of the housing and the second end of the housing in a first direction and in a second direction.

30. A doctor blade system for use on a printing press and having an integrated cooling system comprising:

a doctor blade housing, the housing having a first end and a second end and defining an ink cavity arranged to contain a quantity of ink;

the housing having a cross-section defining a plurality of coolant passages extending generally along a length of the housing, the coolant passages defining a coolant flow path extending between the first end and the second end, at least a portion of the coolant flow passages exposed for conductive heat transfer relationship to the ink cavity;

the housing including a coolant inlet arranged for flow communication with a coolant supply, the housing further including a coolant outlet arranged for flow communication with the coolant return, the coolant inlet and the coolant outlet disposed at opposite ends of the path;

a first header attached to the first end of the housing; and

a second header attached to the second end of the housing, a portion of the flow path proceeding through each of the first and second headers.

31. The device of claim **30**, wherein the housing includes a wall extending between the first end and the second end, and wherein the coolant passages are internally formed in the wall.

32. The device of claim **30**, wherein the housing comprises an extruded aluminum member.

33. The device of claim **30**, wherein the housing comprises a cast member.

34. The device of claim **30**, wherein the coolant inlet is defined in the first header and the coolant outlet is defined in the second header.

35. The device of claim **30**, wherein the coolant inlet and the coolant outlet are both defined in either the first header or the second header.

36. The device of claim **30**, including a first header attached to the first end of the housing and a second header attached to the second end of the housing, and wherein the coolant passages are arranged to define a plurality of flow paths between the first and the second end of the housing.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,688,225 B2
DATED : February 10, 2004
INVENTOR(S) : Gerald N. Shields

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 9,
Line 8, delete "are defined are both defined" and insert instead -- are both defined --.

Signed and Sealed this

Fourteenth Day of June, 2005

JON W. DUDAS
Director of the United States Patent and Trademark Office